



NOTES STREPTOCOCCUS

MICROBE OVERVIEW

Morphology

- Spherical, Gram-positive bacteria; appear in chains/pairs; catalase, coagulase negative
- Produce extracellular substances (e.g. cytolytins, enzymes) → enhance pathogenicity

STREPTOCOCCUS AGALACTIAE (GROUP B STREP)

osms.it/streptococcus-agalactiae

PATHOLOGY & CAUSES

- AKA Group B Streptococcus (GBS)
- Encapsulated, facultative anaerobe
- Colonizes human genital, gastrointestinal (GI) tracts; upper respiratory tracts of young infants
- Beta-hemolytic
 - Blood agar plates, hemolysins degrade lipid membranes → colonies surrounded by narrow zone of hemolyzed cells → complete (beta-)hemolysis

Virulence factors

- Complex capsular polysaccharides
 - Inhibit complement deposition on microbe surface components
- Hypervirulent GBS adhesin (HvgA)
 - ↑ ability to invade blood-brain barrier
- Cluster of virulence responder/sensor (CovR/S) mutation
 - Accelerate failure of amniotic barrier → ↑ ability to penetrate chorioamniotic membranes
- Pilins
 - Act as adhesins → ↑ ability to invade central nervous system, form biofilm

- Direct cytotoxicity to host phagocytes

Common infectious agent

- Adults (nonpregnant)
 - Broad spectrum of infections
- Pregnant individuals
 - Chorioamnionitis
- Neonates
 - GBS infection, sepsis

RISK FACTORS

- Adults (nonpregnant)
 - Chronic disease (e.g. diabetes, liver disease, malignancy; > age 65, esp. residents of nursing homes)
- Pregnancy
- Neonates
 - Ascending infection from mother (e.g. rupture of membranes, chorioamnionitis)
- Hospitalization
 - Nosocomial/hospital-acquired infections

VISIT...

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COMPLICATIONS

- Cystitis, pyelonephritis, urethritis, prostatitis; osteomyelitis, septic arthritis; endocarditis; meningitis; pneumonia; sepsis; toxic shock-like syndrome
- Neonates
 - Preterm birth, bacteremia, sepsis, pneumonia, meningitis, neonatal mortality

SIGNS & SYMPTOMS

- Fever, chills; malaise; cough
- Local tissue infection
 - Red, warm, swollen, presence of drainage

DIAGNOSIS

LAB RESULTS

Identification of microbe

- E.g. blood, cerebrospinal fluid
- Gram stain, characteristic morphology
- Culture
 - Beta-hemolysis on blood agar
- CAMP test
 - Identifies presence of CAMP factor
- Latex agglutination tests
 - Detects antibodies produced in response to GBS

- Hippurate hydrolysis test
 - Detects hippurate hydrolysis by GBS

OTHER DIAGNOSTICS

- Clinical history, physical examination

TREATMENT

MEDICATIONS

- Antibiotics (e.g. penicillin G, ampicillin)

OTHER INTERVENTIONS

- Prenatal screening



Figure 99.1 The three classes of streptococcus cultured on a blood agar plate. Alpha (left) shows partial hemolysis, beta (centre) shows complete hemolysis and gamma (right) shows no hemolysis.

STREPTOCOCCUS PNEUMONIAE

osms.it/streptococcus-pneumoniae

PATHOLOGY & CAUSES

- Causative agent for numerous clinical syndromes in children, older adults
- Alpha-hemolytic, lancet-shaped diplococci
- Lysis by bile (deoxycholate), optochin sensitive
- Fastidious; prefers 5% carbon dioxide
- Pyogenic

- Virulence factors
 - Resistance to phagocytosis (conferred by 92 polysaccharide serotypes)
 - Adherence proteins
 - Biofilm formation
 - Pneumolysin toxin
- Asymptomatic colonization → direct spread from site of colonization, hematogenous spread → clinical syndromes

- Typical infections caused by *S. pneumoniae* range from mucosal to invasive diseases
 - Meningitis
 - Otitis media
 - Pneumococcal community-acquired pneumonia
 - Sinusitis

RISK FACTORS

- Age (< 2, ≥ 65 years)
- Underlying disease (e.g. liver, kidney, heart, lung, diabetes, malignancies)
- Crowded conditions (e.g. daycare centers, military camps, prisons)
- Immunodeficiency (e.g. HIV, genetic immune defects, solid organ/bone transplant)
- Smoking, alcohol abuse

COMPLICATIONS

- Pneumococcal endocarditis, empyema, bacteremia, sepsis

SIGNS & SYMPTOMS

- Common clinical presentation
 - Fever, altered mental status, malaise
- Typical findings related to clinical syndrome
 - Meningitis: headache, neck stiffness
 - Otitis media: ↓ tympanic membrane mobility/bulging membrane, otorrhea, pain
 - Pneumonia: cough, bronchial breath sounds, rales
 - Sinusitis: purulent rhinitis, mucous membrane edema, headache

DIAGNOSIS

DIAGNOSTIC IMAGING

Chest X-ray

- Infiltration, consolidation (pneumonia)

LAB RESULTS

Identification of organism

- Gram-positive diplococci, positive culture, polymerase chain reaction (PCR)
- Urine antigen analysis (bacteremia)

OTHER DIAGNOSTICS

- Clinical history, physical examination

TREATMENT

MEDICATIONS

- Antibiotics
 - Pneumonia: beta-lactam antibiotic
 - Otitis media: amoxicillin-clavulanate (children)
 - Sinusitis: amoxicillin (amoxicillin-clavulanic acid may be preferable)

OTHER INTERVENTIONS

Prevention

- Pneumococcal vaccine

STREPTOCOCCUS PYOGENES (GROUP A STREP)

osms.it/streptococcus-pyogenes

PATHOLOGY & CAUSES

- AKA Group A Streptococcus (GAS)
- Colonizes human skin, mucous membranes
- Cell-wall structure
 - Peptidoglycan backbone + lipoteichoic acid components → structural stability
- **Beta-hemolytic**
 - Blood agar plates, hemolysins degrade lipid membranes → colonies surrounded by clear zone of hemolyzed cells → complete (beta-) hemolysis
- Primarily infects skin, soft tissue

Virulence factors

- Vary with specific strain
- **M proteins**
 - **Protect** **microbe** from humoral immune surveillance, **phagocytosis** by polymorphonuclear leukocytes
- Binding proteins
 - Bind to IgG, IgM, IgA → may interfere with complement activation
 - **Protein F**: binds to fibronectin → ↑ adherence to epithelial surfaces
- Cytolysins
 - **Streptolysins**: bind to cholesterol on eukaryotic cell membranes → **cell lysis**
 - **Hyaluronidase**: hydrolyzes hyaluronic acid → facilitates infection spread
 - **Streptokinase**: proteolytically converts bound plasminogen to active plasmin → cleavage of fibrin; medically useful as clot-busting drug
 - **Nicotinamide adenine dinucleotidase (NADase)**: exact function unclear; likely ↑ invasiveness
 - **Deoxyribonuclease**: promotes production of anti-deoxyribonuclease (DNase) antibody following pharyngeal/skin infections

- Pyrogenic **exotoxins** (type A, B, C)
 - Induce fever, act as superantigens → T-cell proliferation → ↑ **cytokine production** → promotes **shock**
- Streptococcal inhibitor of complement (SIC)
 - Inactivates complement membrane attack complex
- Opacity factor (OF)
 - Lipoprotein lipase

Causative agent in several disorders

- Pyogenic diseases
 - **Pharyngitis**, **cellulitis** (abscess formation in dermis, subcutaneous fat layers), necrotizing fasciitis (progressive destruction of deep soft tissue), **impetigo**
- Toxigenic disease
 - **Scarlet fever**, **toxic shock syndrome**, GAS endometritis (puerperal sepsis)
- Immunologic disease
 - **Rheumatic fever** (antibodies against streptococcal cell cross-react with cardiac tissue); poststreptococcal **glomerulonephritis** (immune complexes deposited in glomeruli)

RISK FACTORS

- Susceptible host + encounter with streptococcus expressing specific virulence factors

COMPLICATIONS

- Local spread (e.g. otitis media, sinusitis, mastoiditis); tissue destruction; valvular, renal disease; sepsis, shock, multiorgan failure; disseminated intravascular coagulation; pediatric autoimmune neuropsychiatric disorder associated with group A streptococci (PANDAS)

SIGNS & SYMPTOMS

- Pharyngitis
 - Acute onset of sore throat, fever, pharyngeal edema, patchy tonsillar exudates
- Cellulitis
 - Erythema, edema, abscess formation
- Impetigo
 - Papules, vesicles, pustules surrounded by erythema pustules → breaks down, forms crusts
- **Scarlet fever**
 - Erythematous **rash**
- Toxic shock syndrome
 - **Shock**, multiorgan failure
- GAS endometritis
 - Postpartum fever, uterine tenderness

DIAGNOSIS

LAB RESULTS

Identification of microbe

- Gram positive cocci
- Positive culture
- Blood studies
 - Rapid antigen detection test (RADT) for GAS

OTHER DIAGNOSTICS

- Clinical history, physical examination

TREATMENT

MEDICATIONS

- Antibiotics (e.g. **penicillin G**, clindamycin)

SURGERY

- Surgical debridement

STREPTOCOCCUS VIRIDANS

osms.it/streptococcus-viridans

PATHOLOGY & CAUSES

- Heterogeneous collection of **alpha/nonhemolytic** streptococci, cause variety of diseases
- Some species produce greenish color on blood agar plates
- **Not bile soluble**, **optochin resistant**
- Approx. 30 species classified into six groups
- **Part of microbiome** of oropharynx, GI, genitourinary tract
- May be invasive, produce variety of diseases
 - **Dental caries**, periodontal disease, maxillofacial infections, exudative pharyngitis, infective **endocarditis**
 - Invades circulation → systemic

infections (e.g. abdominal, central nervous system, lung, skin, soft tissue, sepsis)

- Abscess formation
- Viridans streptococcal shock syndrome

RISK FACTORS

- Immunocompromised state
- Periodontal disease
- More common in children than adults
- Comorbidities (e.g. mucositis, cystic fibrosis, malignancies)
- Altered microbiome

SIGNS & SYMPTOMS

- Clinical presentation varies widely depending on infection

DIAGNOSIS

LAB RESULTS

Identification of organism

- Gram-positive cocci, positive culture

OTHER DIAGNOSTICS

- Clinical history, physical examination

TREATMENT

MEDICATIONS

- Antibiotics (depending on sensitivity, resistance)
 - Penicillin + aminoglycoside; broad-spectrum cephalosporin, vancomycin

SURGERY

- Abscess debridement/drainage